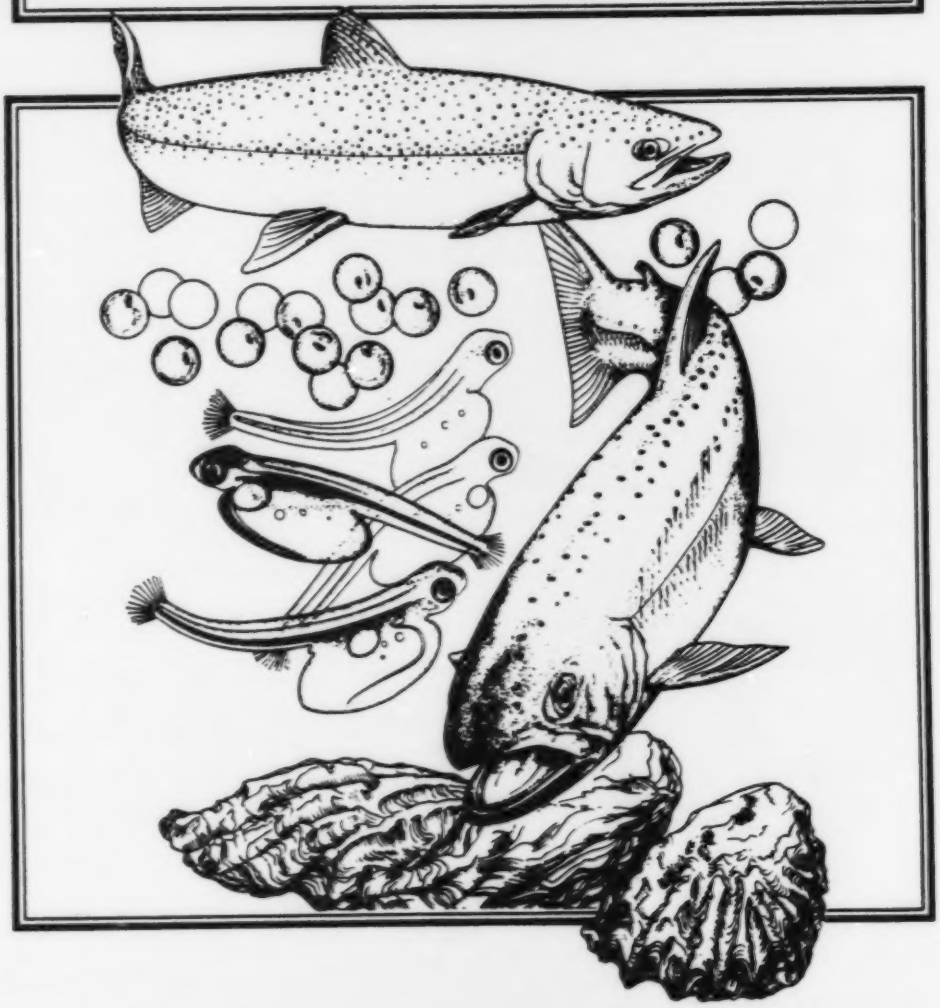
Aquaculture Industry Development Report

The B.C. Aquaculture Supply & Service Sector: Critical Issues in 1990



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THE B.C. AQUACULTURE SUPPLY AND SERVICE SECTOR:

CRITICAL ISSUES IN 1990

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

1.0 INTRODUCTION 1–1

2.0 IMPORT SUBSTITUTION OPPORTUNITIES 2-1

2.1 Introduction 2-1
2.2 Methodology 2-2
2.3 Netpen Systems 2-4
2.4 Barges 2-8
2.5 Feed 2-11
2.6 General Supplies 2-14
2.7 New Product Opportunities 2-16
2.8 Import Substitution Opportunities 2-18

3.0 IMPACTS FROM THE RESTRUCTURING OF THE B.C. SALMON FARMING INDUSTRY 3–1

3.1 Introduction 3-1
3.2 Methodology 3-1
3.3 Classification of Aquaculture Suppliers Surveyed 3-2
3.4 1989 Sales to the Aquaculture Industry 3-2
3.5 History in the Industry 3-5
3.6 Change in Sales Status From 1988 to 1989 3-5
3.7 Expected 1990 Sales Status Compared to 1989 3-7
3.8 Changes in Business Practices 3-8
3.9 Employment and Staffing Changes 3-9
3.10 Receivership in 1988/89 3-11
3.11 Government Funding Programs Utilized 3-12
3.12 Export Development Potential 3-12
3.13 Export Development Potential 3-13

REFERENCES

EXECUTIVE SUMMARY

A. Introduction

Aquaculture production in Canada has increased from 6,000 tonnes in 1985 to 30,000 tonnes in 1989. The British Columbia salmon farming sector was the largest contributor to this growth. Areas which the British Columbia supply and service sector can explore as new potential markets need to be identified in order to: increase economic benefits to the province through import substitution; and, increase productivity of the aquaculture sector.

A number of independent factors combined in 1989 to depress the world market for salmon and cause a restructuring of the British Columbia salmon farming industry. The number of salmon farms in B.C. was reduced from 80 in 1988 to about 50 in 1989. The impact of the rationalization of the salmon farming industry on the supply and service sector has not been well defined or quantified.

The objectives of the present study therefore are to:

1) Identify and quantify opportunities and constraints for the British Columbia aquaculture supply and service sector to replace out-of-province imports;

2) Assess the impacts and effects of the financial downturn in British Columbia's salmon farming industry on the aquaculture supply and service sector.

B. Import Substitution Opportunities

A detailed survey of 14 salmon farm companies, who represented the majority of B.C. production capacity, was conducted. This study has shown that the vast majority of the supplies and services used by the B.C. salmon farming industry are currently purchased locally. This was found to be the case in cage manufacturing, barge

supply, production salmon feed supply, and general supplies and services to the industry. Specialized sectors which the industry must rely on imports for are moist smolt feed and automatic feeding systems.

The salmon farming companies surveyed comprised in excess of 80% of the total production volume of the industry. The number of individual cage units captured in this study totalled nearly 1,500. It was found that 80% of the cage units were locally manufactured, with 65% of the total number being locally produced steel netpen systems. Home made wooden systems comprised a significant portion of the total at 11%. Imported steel netpen systems from overseas constituted 10% of the total and Eastern Canadian imports were 6%.

All salmon farming companies indicated that they planned on utilizing locally manufactured netpen systems in all their future purchases. High quality second-hand netpen systems will be preferred by several companies.

The next two years will see a requirement for steel netpen cages in the order of 175 units from the 14 companies surveyed in detail.

All of the barges currently used in the industry are locally manufactured, with 74% purchased from local companies and 26% homemade.

Salmon feed represents one of the largest areas of the supply and service sector to the industry. Although there are three local manufacturers of salmon feed in B.C., there were a number of companies which were importing quantities of salmon feed from the United States during 1989. This study showed that 50% of the production companies included in this survey had imported out-of-province feed in the past. However, only 14% indicated that they were currently importing out-of-province feed.

Follow-up discussions with several companies indicated some most were not satisfied with the quality of the U.S. feed they received, with poor quality control and lower palatability with the fish.

However, four companies surveyed from the industry currently utilize exclusively U.S. feed. Discussions with them indicated that they were quite satisfied with the product and the growth performance of their fish.

A lower price in 1989 of U.S. production feed was the primary reason given for using it initially. Several other companies were using it last year, but they have subsequently been placed into receivership.

The hatchery sector currently utilizes U.S. moist feed exclusively for their smolt production facilities. All indicated that higher quality product was their primary reason for importing it. This is clearly an area in which local feed producers should be able to exploit.

Automatic feeders are also currently imported extensively from Europe and the U.S. The reason for this is a lack of a suitable product available locally. Feeding systems are becoming more technologically advanced, with boom, blower and hydraulic pipe systems all now being utilized. There is a strong movement in the industry towards more cost-efficient production. Clearly, more efficient feeders and feed handling will be part of the solution. Demand feeders may be the next generation of feeding systems for salmon farms. Opportunities will therefore exist for local manufacturers to diversify into this highly specialized sector.

In the area of general supplies and services to the salmon farming industry, the vast majority of the salmon farming companies indicated that they anticipated relying on locally available supplies and services to meet their 1990 needs. Exceptions to this were feeders and feeding systems. Several companies indicated they would be relying on imports for their antibiotics, predator control devices and vaccines. In the service

sector, 28% of the companies in this survey indicated they would be relying on an import service for their insurance requirements. Computer, legal, and fish diagnostic services would be minor services with minor import components.

Opportunities for the supply and service sector to expand and improve their product line to the salmon farming industry include:

- More effective pharmaceuticals, vaccines and treatments (i.e. for BKD).
- More accurate inventory control systems.
- Low stress graders for smolts and larger fish.
- Automatic fish injection vaccinators.

C. Impacts & Effects from the Restructuring of the B.C. Salmon Farming Industry

A total of 44 aquaculture supply and service sector companies were surveyed. These companies included the most significant suppliers to the B.C. salmon farming industry.

There were 45% of the companies which had sales of less than 10% to the aquaculture industry. Another 21% had sales in the range of 10% and 50%. There were about a third which indicated that over 90% of their sales were to the aquaculture industry.

The majority of the companies (61%) became involved in the industry three to four years ago when the expansion began. The survey indicated that 52% of the supply and service sector companies increased their sales in 1989 compared to 1988 while 30% saw their sales decreases. Another 18% said their sales remained the same both years. Of the Companies that reported reduced sales in 1989, 50% of the companies had their sales decline between 20% to 50% from 1988.

Those companies which saw their sales decline dramatically were companies which had a substantial proportion of their sales (i.e. 50% or more) to the aquaculture industry. Because of their dependence on the aquaculture industry for their sales, the

economic downturn of the industry hit these companies the hardest. These companies included netting companies and specialized aquaculture supply and service sector companies.

In comparing expected 1990 sales to 1989 sales, 28% of the companies indicated their sales would increase. The largest percent (41%) hoped that their sales would remain the same for the most part. Those companies indicating their sales would be up believed that sales would increase only between 1% to 10% in 1990.

The aquaculture supply and service sector changed their business practises as a result of the financial downturn in the industry in 1989. A total of 40% of the companies responded that it was very important or essential they sell only to preferred customers. Another 40% of the companies indicated they were tightening all credit terms to salmon farming companies.

While there were 23 positions created by the 44 companies surveyed over the last two years, there were another 50 positions lost as a result of the financial downturn.

Aquaculture supply and service sector companies find it difficult to access government funding programs. Three areas were identified in which the government can more effectively assist the aquaculture and service sector:

1) Easier access to funding programs;
2) Expanded export development programs;
3) Expanded Social Service Tax exemptions.

The financial downturn of the salmon farming industry in 1989 forced many companies to look abroad for sales in light of the reduced spending by the industry in B.C. While the U.S. is currently the major export market, Norway, Scotland, Chile and the East Coast of Canada are all areas of market expansion for these companies.

1.0 INTRODUCTION

The aquaculture industry in Canada is presently emerging from a period of rapid growth which has seen dramatic increases in production and value of harvests. Aquaculture is broadly defined as the cultivation and harvesting of aquatic plants and animals including finfish, shellfish, and seaweeds. Species presently cultured in Canada include Atlantic and Pacific salmon, rainbow trout, several species of oysters and scallops, blue mussels, and Arctic char. Candidate species include manila clams, halibut and cod.

Exhibit 1.1 highlights the growth of the individual production segments of the aquaculture industry in Canada and provides an indication of the size of the industry and diversity of the species now cultured. Exhibit 1.1 also shows how aquaculture production in Canada has grown nearly five fold between 1985 and 1989. Canadian farmed salmon sales for 1989 had an estimated wholesale value of $125 million. This industry is export driven, with over 70% of farmed salmon is exported to the United States. The salmon farming industry, in particular, has revitalized the economies of southwestern New Brunswick and some coastal communities in British Columbia.

The development of the salmon farming industry in British Columbia has been one of the most rapid of any other producing region in the world. A handful of small producers produced a mere 120 tonnes in 1985. In 1986 and 1987 the number of sites increased dramatically and by 1989 there were 135 sites which produced 12,400 tonnes valued at $80 million. The total investment in the industry to date has been estimated $200 million.

The aquaculture supply and service sector has expanded along with the continued growth of the industry. A study of British Columbia's salmon farming supply and service sector was conducted by the B.C. Salmon Farmers Association in 1987. The study indicated that the supply and service sector's total sales to the industry more than doubled from $22 million in 1986 to $48 million in 1987. Person-years of employment generated by salmon farming in the supply and service sector was 364 PY's in 1987.

An issue facing the aquaculture supply and service sector in British Columbia is the extent to which out-of-province imports have adversely affected the local supply and service sector of the industry. Areas which the local supply and service sector can explore as new potential markets need to be identified in order to: increase economic benefits to the province through import substitution; and, increased productivity of the aquaculture sector.

The worldwide decline in both commercial and farmed salmon prices by 30-40% in 1989 precipitated a restructuring of British Columbia's salmon farming industry. A number of independent factors combined in 1989 to depress the world market for salmon and subsequently caused a price decline in excess of 30% for all salmon products: a dramatic increase in worldwide farmed salmon production to over 200,000 tonnes; the largest wild salmon harvest ever recorded in Alaska; a levelling off of per capita consumption of fresh/frozen seafood in the U.S. after significant increases since 1980 as well as slight reductions in per capita consumption in Japan. There were over 20 receiverships or change of ownerships of B.C. salmon farming companies, including one of the largest vertically integrated companies in the industry. This restructuring resulted in several supply and service sector company receiverships as well as reduced sales or loss of revenue with other companies serving the salmon farming industry. The impact of the restructuring of the salmon farming industry on the supply and service sector has not yet been well defined or quantified.

The purpose of the present study is to examine in detail each of the above issues. Specific objectives of the study are:

1) To identify and quantify opportunities and constraints for the British Columbia aquaculture supply and service sector to replace out-of-province imports.

2) To assess the impacts and effects of the financial downturn in British Columbia's salmon farming industry on the aquaculture supply and service sector.

EXHIBIT 1.1: GROWTH OF AQUACULTURE INDUSTRY PRODUCTION IN CANADA (Tonnes)

	1985		1989	
	B.C.	Other Canada	B.C.	Other Canada
Salmon	120	350	12,100	4,500
Oysters	3,420	1,000	4,000	3,000
Mussels	--	500	20	2,700
Marine Trout	--	--	300	250
Freshwater Trout	80	625	125	2,700
Arctic Char	--	--	--	10
TOTAL	3,620	2,475	16,545	13,160

SOURCE: Compiled from various industry sources by BCSFA. February, 1990

2.0 IMPORT SUBSTITUTION OPPORTUNITIES

2.1 Introduction

The rapid expansion of the aquaculture industry in British Columbia since 1986 has seen a tremendous increase in demand for required specialized supplies and services. The salmon farming sector in particular experienced the largest growth and offered considerable opportunities for the supply and service sector to diversify into this new industry.

In 1987, a study to determine the economic impact of salmon farming on the supply and service sector in the province showed that there were over 216 companies involved in this sector employing the equivalent of 364 person-years. Capital expenditures by the supply and service sector were $24 million in 1986 and $30 million in 1987. Sales to the industry totalled $22 million in 1986 and doubled to $49 million in 1987. The supply and service sector had therefore developed rapidly to meet the growing demands of the industry.

In 1986, many of the requirements of the salmon farming companies for essential goods and equipment such as steel netpen systems, salmon feed and automatic feeding systems could not be sourced within B.C. or Canada. As a result, there was a significant volume of specialized goods and equipment that had to be imported from Norway and elsewhere.

Although the salmon farming industry's supply and service sector was fully in place and providing the industry with all essential requirements by late 1987, imports of supplies and services are still occurring in British Columbia. This is due to two reasons:

1) No domestic supplier of the supply/service.
2) Increased level of competition from international suppliers of products that are preferred by local salmon farmers.

The objectives of this section of the report are to:

- identify and quantify the level of existing imports of the major supplies and services to the British Columbia salmon farming industry.
- determine from this list which supplies and services can feasibly be undertaken by local companies to replace existing imports.
- identify import product advantages that currently make them more advantageous to B.C.'s salmon farmers than local supplies and services.
- gauge the 1990 purchase requirements of B.C.'s salmon farming industry.

2.2 Methodology

In order to meet the objective of identifying and quantifying the current level of imports of supplies and services to the salmon farming industry, a detailed survey of 14 salmon farming companies was performed. The four target areas of the survey included:

- Netpen Systems
- Barges
- Feed
- General Supplies

The salmon farming company selection process for the study was based on the current structure of the B.C. salmon farming industry. Production is becoming increasingly concentrated by larger companies. Exhibit 2.1 illustrates how 75% of the industry's 1990 production of 15,000 tonnes will be produced by just nine companies.

Companies surveyed were selected to reflect this trend towards concentration of production. Exhibit 2.2 provides a breakdown by production size of the companies included in the study. Five of the nine largest producers provided results to the

questionnaire. Another five 200 - 500 tonne producers were included, as were four small

producers. Nearly 50% of the industry's production was captured in this study. An additional four smolt production companies were also surveyed.

In order to obtain the most accurate figures possible for the questions pertaining to netpen systems, the remaining four large producers were contacted. This raised the percentage of the industry's production included in this part of the study to about 80%.

EXHIBIT 2.1: CONCENTRATION OF PRODUCTION IN THE B.C.SALMON FARMING INDUSTRY

Size of Category Tonnes	Number of Companies	1990 Aggregate Production Forecast Tonnes	%
1,000 +	4	8,250	55
500 - 1,000	5	3,000	20
200 - 500	11	3,000	20
< 200	30	750	5
TOTALS	**50**	**15,000**	**100**

SOURCE: B.C. Salmon Farmers Association
February, 1990

EXHIBIT 2.2: SALMON FARMING COMPANIES INCLUDED IN SURVEY

Size of Company (Tonnes)	No. of Companies	1990 Aggregate Production Forecast (Tonnes)	% of Industry Production
1,000 +	2	3,000	20
500 - 1,000	3	2,000	13
200 - 500	5	1,800	12
< 200	4	300	2
Hatcheries	4	--	--
TOTALS	18	7,100	47

2.3 Netpen Systems

Netpen systems are the single most important equipment purchase by salmon farming companies, as well as being the largest initial capital cost. Typically, a 12 unit 15 m x 15 m system will cost in the range of $225,000 and constitute about one-half of the total initial investment in a salmon farm. The fish contained within the netpen system are of considerably greater value. The siting and choice of a netpen system is therefore one of the most important decisions of a salmon farming company.

When the British Columbia salmon farming industry began its' expansion in the spring of 1986, there were seven suppliers of netpen systems to the industry. Three were suppliers of locally produced netpen systems; the other four distributed systems manufactured in Europe and Eastern Canada. The following table identifies the manufacturers at this time.

Suppliers of Locally Produced Netpen Systems in 1986:

Company	Location
Topper Floating Structures (Division of Rivtow Straits Ltd.)	Delta, B.C.
Aquasteel Ltd.	North Vancouver, B.C.
Skookumchuck Ltd.	Sechelt, B.C.

Suppliers of Imported Netpen Systems in 1986:

Company	Location
Scantech Resources Ltd. (Undertun)	Sechelt, B.C.
Oppdrett Service Canada Ltd. (Viking)	North Vancouver, B.C.
Crown Aqua (Kames)	Sechelt, B.C.
Polar Circle Products	Campbell River, B.C.

By 1987, Oppdrett Service Canada Ltd. were manufacturing all of their netpen systems locally. Another company, Aquacan Ltd., were manufacturing locally an Irish designed netpen system called Wavemaster. Aquacan's manufacturing rights for Wavemaster were subsequently purchased by Topper Floating Structures Ltd. A variety of other minor manufacturers of steel, plastic and wood netpen systems also emerged over this period.

The restructuring of the salmon farming industry in British Columbia in 1989 had serious repercussions on the cage manufacturing sector. There were a number of receiverships of cage manufacturers, including Scantech, Skookumchuck, and Aquasteel.

The only two remaining domestic manufacturers of netpen systems which supply the vast majority of the industry's current requirements are Oppdrett Service Canada Ltd. and Topper Floating Structures Ltd.

Utilization of Locally Manufactured vs Imported Netpen Systems

Exhibit 2.3 displays the breakdown of locally manufactured and imported netpen systems based on the number of individual cage units utilized by the 14 companies included in the detailed study, as well as an additional four of the largest salmon farming companies in the industry. These figures represent in excess of 80% of the total production capacity of the industry. The number of individual cage units captured in the study totalled nearly 1,500.

Exhibit 2.3 indicates that in January 1990, 80% of all netpen cages used in the industry had been locally manufactured compared to 20% that had been imported. Local manufacturers of steel netpen systems comprise 65% of the total number of operational cages in the industry at present. Homemade wooden systems were a significant 11% of the total number of cages. Locally manufactured wooden and plastic systems are a minor portion of the industry netpen systems at 4%.

Imported steel netpen systems from overseas constituted 10% of the total and Eastern Canadian imports were 6%. Imported plastic cages were found to be only 4% of the total cages in use at present. All imported cages were steel or plastic.

Age Distribution of Existing Steel Netpen Systems In The B.C. Salmon Farming Industry

Exhibit 2.4 displays the age distribution of the steel netpen systems included in the survey. It indicates that 28% of the cages are greater than three years old and 33% are one year old or less.

With respect to expected life span of their steel pen systems, most salmon farmers contacted indicated that they anticipated obtaining at least 10 years out of all of their netpen systems. Some also felt that 15 years of life was not unrealistic for sites which are not exposed to severe wave conditions.

EXHIBIT 2.3: LOCALLY MANUFACTURED AND IMPORTED NETPEN SYSTEM USED IN THE B.C. SALMON FARMING INDUSTRY (JANUARY 1990)

	Number of Cages	%
Locally Manufactured		
- Steel	977	65
- Homemade	171	11
- Wooden	26	2
- Plastic	30	2
Subtotal	**1,174**	**80**
Imported		
- Overseas (steel)	150	10
- Central/Eastern Canada (steel)	88	6
- Plastic	84	4
Subtotal	**322**	**20**
TOTAL	**1,496**	**100**

EXHIBIT 2.4: AGE DISTRIBUTION OF EXISTING STEEL NETPEN SYSTEMS IN THE B.C. SALMON FARMING INDUSTRY

Age (Years)	Number of Cages	%
< 1	85	7
1	316	26
2	474	39
3	255	21
4	85	7
TOTAL	**1,215**	**100**

Reasons For Importing Steel Netpen Systems

Exhibit 2.5 displays the reasons for those companies which imported out-of-province steel netpen systems. The primary reason for most companies importing steel netpen systems was due to the unavailability of locally manufactured systems at the time of purchase. A perceived higher quality of out-of-province systems was also a relatively important factor for some companies. Lower price, better after sales service, and better financing were not as important as the first two factors.

Anticipated Purchase of New Cages in the Next Two Years

Exhibit 2.6 displays the anticipated purchase of new cages in the next two years by the 14 companies surveyed in detail. There was a 75% positive response to this question. A total of 175 galvanized steel units can be expected to be purchased over the next two years from these companies. Plastic cages will comprise a smaller portion of the market. Two salmon farming companies specifically indicated they were looking for receivership opportunities for their netpen requirements. Several others that were contacted by phone also indicated their preference for receivership opportunities of netpens of known quality.

All companies indicated their preference for obtaining locally manufactured netpens. The cost of imported cages make them uncompetitive compared to the local manufacturers. The salmon farming companies also believe that the quality of the netpens manufactured locally by the major companies is certainly equal to or better than imported netpen systems.

2.4 Barges

The 14 production salmon farms indicated that they had a total of 41 barges at their various farm sites. Of these, 73% were locally manufactured and 27% were homemade. There were no imports reported for barges.

When asked if purchases of barges were anticipated during the next two years, 50% of the companies indicated that they were. A total of eleven barges are expected to be purchased by the companies surveyed.

All of the barges were less than three years old. Their durability makes their replacement time at least ten years from the date of purchase. As a result, their future purchases are lower than for cages as there is typically just a single barge per site.

EXHIBIT 2.5: REASONS FOR IMPORTING STEEL NETPEN SYSTEMS (5 = PRIMARY REASON 1 = NO INFLUENCE)

	Average Weight
- Unavailability of Locally Manufactured Product At Time of Purchase	4
- Higher Quality	3
- Lower Price	2.5
- Better After Sales Service	2
- Financing	2

EXHIBIT 2.6: ANTICIPATED PURCHASES OF NETPEN SYSTEMS DURING THE NEXT TWO YEARS

	% of Companies
Intend to Purchase Netpens	75%
No Intent to Purchase Netpens	25%
Type	**No. of Cages**
12 m x 12 m Galvanized Steel	42
15 m x 15 m Galvanized Steel	133
Circular Plastic	10
TOTAL	**185**

Note: Two companies specifically indicated they were looking for receivership opportunities

EXHIBIT 2.7: LOCALLY MANUFACTURED BARGES USED IN THE B.C. SALMON FARMING INDUSTRY

	Number	%
Locally Manufactured		
Feed	19	46
Accommodation	6	15
Feed/Accommodation	5	12
Subtotal	**30**	**73**
Homemade	11	27
TOTAL	**41**	**100**

Note: No imports of barges were reported.

EXHIBIT 2.8: ANTICIPATED PURCHASE OF NEW BARGES IN THE NEXT TWO YEARS

Anticipated Purchase of New Barges	50%
No Purchase of New Barges	50%

Type	**Number**
Accommodation	5
Feed	4
Combination	1
Processing	1
TOTAL	**11**

2.5 Feed

Successful salmon farming depends largely upon the provision of a high quality, nutritionally balanced feed in order to ensure that the highest quality salmon is ultimately produced. The growth of the salmon farming industry in British Columbia resulted in the formation of three companies which supply the industry with its requirements. Two of these companies, Moore Clark Canada Ltd. and White Crest Mills Ltd., are exclusively devoted to supplying salmon feed while the third company, EWOS Canada Ltd., supplies other agricultural feeds as well as salmon feed.

The increase in price of salmon feed over the last two years caused a number of salmon farming companies to look to the United States as a potential supplier of salmon feed. The largest supplier of trout feed in the U.S. is Rangen Inc. of Buhl, Idaho. They have diversified their feed formulation to salmon. The company now has a distributor in British Columbia and is actively seeking to expand its presence in the B.C. industry. Another U.S. company which sells to a smaller number of companies in B.C. is Silver Cup Feeds

Ltd. of Murray, Utah. A third company which sells extensively to the hatchery sector in B.C. is Bioproducts Inc. of Warrenton, Oregon.

Market Penetration of Imported Salmon Feed

Exhibit 2.9 displays the aggregate responses of the 14 production companies and four hatchery companies included in the survey with respect to use of feed imports. There were 50% of the production companies surveyed that had imported out-of-province feed in the past. All of the hatchery companies surveyed indicated that they had imported feed as well. However, only 14% of the production companies surveyed indicated that they were currently importing out-of-province feed. All the hatchery companies are continuing to use the moist smolt feed manufactured by Bioproducts.

With those production companies that were no longer importing out-of-province feed, several of them indicated problems with the quality of the feed. Also, the price of the locally manufactured feed has dropped during 1989 and is now more competitive with the imported feed price.

Exhibit 2.9 provides the reasons given for continuing to import out-of-province feed. Lower price was the primary reason for importing U.S. feed whereas nutritional quality, after-sales service and better financing were less significant reasons.

The unavailability of a local manufacturer of a moist smolt feed has resulted in nearly all hatcheries in the province having to import their feed from the U.S. This may be an area which the local feed companies can exploit in order to expand their sales.

Four companies in the industry are known to utilize exclusively U.S. feed. Discussions with them indicated that they were quite satisfied with the product and the growth performance of their fish. A lower percentage of fines and molds were another two positive attributes given by the companies.

EXHIBIT 2.9: IMPORTS OF OUT-OF-PROVINCE FEEDS TO THE B.C. SALMON FARMING INDUSTRY

	Production	Hatchery
Past Import of Out-of Province Feed	Yes 50%	Yes 100%
	No 50%	No --
Currently Importing Feed	Yes 14%	Yes 100%
	No 86%	No --

EXHIBIT 2.10: REASONS FOR IMPORTING OUT-OF-PROVINCE FEEDS (5 = PRIMARY REASON 1 = NO INFLUENCE)

	Production	Hatchery
Lower Price	5	
Better Nutritional Quality	3	5
Better After Sales Service	3	
Better Financing	3	

Feeders

A wide variety of feeding systems on production farms are now used. However, the vast majority of them are now imported from out-of-province. The most popular systems include Aquatess from Norway, Kemers Maskin of Sweden, and Harrington Manufacturing Corp. of Idaho.

The primary reasons given for using imported feeders are unavailability of a comparable local product, superior feeding system design and efficiency of the imported products.

2.6 General Supplies

Overviews of the 1990 purchase requirements of the salmon farming companies and two selected shellfish companies were obtained by asking them to indicate anticipated 1990 purchases from a list of supplies and services. These are presented in Exhibits 2.11 and Exhibit 2.12. The number accompanying each supply and service item indicates the percentage of the companies surveyed which anticipated purchasing the supply or service during 1990. Using aeration/oxygenation equipment as an example, 22% of the companies indicated that they expected a purchase of this type of item in 1990 and 6% of the total anticipated buying an imported product.

Products for which a high demand is expected during 1990 include:

- antibiotics and vaccines
- polystyrene boxes
- dissolved oxygen meters
- nets, ropes and twines
- predator control devices
- pumps, and pvc pipes.

The supply list indicates that nearly all the salmon farming companies expect to be able to purchase their requirements in British Columbia and will only minimally have to rely on imports to fulfil their needs. The three areas in which imports are expected in any significant degree are:

- antibiotics
- predator control devices
- feeding systems

A wide range of services are anticipated to be utilized during 1990 by the salmon farming industry. These are presented in Exhibit 2.10. The four areas in which demand will be the highest will be:

EXHIBIT 2.11: ANTICIPATED 1990 SUPPLY REQUIREMENT OF B.C. SALMON FARMING COMPANIES

% of Companies 1990 Purchase Expected	% of Companies Import Anticipated	Supply
22	6	Aeration/Oxygenation
17	6	Alarms/Monitors
44	11	Anchor Systems & Chains
78	17	Antibiotics
39		Boats (Service & Landing Craft)
50		Boxes (Polystyrene)
44		Cage Systems
		Current Meters
11		Data Recorders
44	6	Depuration Systems
50		DO Meters
28	6	Diving Equipment
28		Electricity Generators
17	17	Feeders & Feeding Systems
		Fish Pumps (i.e. Vacuum & Archinedos Screw)
22		Floating Structures & Pumps
17		Fork Lifts
44		Gases
28		Hatchery Equipment (i.e.tanks, troughs, incubators)
33	6	Hydraulic Equipment
22	6	Instruments & Electronics
17		Inventory Equipment
		Mussel Equipment
6		- Mussel socks
6		- Net Bags
6		- Plastic Netting
11		- Floats & Buoys
11		- Ropes
83	6	Nets/Rope/Twine
		Oyster Equipment
		- Polyethelene growing cages
		- Trays
11		- Processing Equipment
6		pH Meters
61	17	Predator Control Devices
61	6	Pumps
50		PVC Pipes/Fittings
22		Transport Tanks & Equipment
61	11	Vaccines
44		Net Washing/Cleaning Equipment

- accounting
- legal
- fish Diagnostic
- insurance

Insurance was the only service in which a significant import was expected. However, because the insurance companies are international companies with offices, this question may have been misinterpreted.

EXHIBIT 2.12: ANTICIPATED 1990 SERVICE REQUIREMENTS OF THE B.C. SALMON FARMING INDUSTRY

% of Companies 1990 Service Expected	% of Companies Import of Service	Service
		Consulting
56		- Accounting
33	6	- Computer
61	6	- Legal
11		- Management/Financial
22		- Mechanical
6		- Site Analysis/Environmental
17		- Engineering (System Design/Optimization
94	6	Fish Diagnostic/Veterinarian Services
83	28	Insurance
22		Marketing & Market Research

2.7 New Product Opportunities

Salmon farming companies were asked which products and services are currently unavailable or not developed at present which would be highly cost effective to their operations. These are displayed in Exhibit 2.13.

More effective pharmaceuticals, vaccines and treatment methodologies were identified by nearly 45% of the companies as being a priority, particularly for treatment of Bacterial Kidney Disease.

More accurate inventory control systems were identified by nearly 40% of the companies as being needed. The vast majority of companies are still using the swim-through video method which can be stressful for the fish for inventory control.

Low stress graders were identified by 33% of the companies as being needed. These are required by both smolt producers as well as production companies. Archimedes screw water conveyors have greatly facilitated the grading process. Graders for smolts and production fish are available. However, more efficient and lower stress graders are still felt to be required by some companies.

Several other items were specified as being required by smolt producers and salmon farming companies, for example, automatic vaccinators for smolts and larger fish. Disease treatment of salmon is advancing to a point where vaccination of larger fish will be occurring which will require a machine/instrument to facilitate this procedure at production farms.

EXHIBIT 2.13: COST-EFFECTIVE PRODUCTS/SERVICES REQUIRED BUT UNAVAILABLE OR NOT YET DEVELOPED

	% Of Companies
Better Pharmaceuticals & Vaccines (i.e. BKD)	44%
More Accurate Inventory Control Systems	38%
Low-Stress Graders (Smolts and Production)	33%
More Efficient Feeding Systems	11%

Other items specified were:

- Automatic Vaccinator (smolts and larger fish)
- Predator Deterrents
- Better net-changing/washing equipment
- Non-toxic algicide for nets/decking

2.8 Import Substitution Opportunities

This study has shown that the vast majority of the supplies and services used by the B.C. salmon farming industry are currently purchased locally. This was found to be the case in cage manufacturing, barge supply, production salmon feed supply, and general supplies and services to the industry. Specialized sectors for which the industry must rely on imports are moist smolt feed and automatic feeding systems.

To specifically determine the extent of imports of netpen systems in the industry, 18 salmon farming companies were surveyed which comprised in excess of 80% of the total production capacity of the industry. The number of individual cage units captured in this study totalled nearly 1,500. It was found that 80% of the cage units were locally manufactured, with 65% of the total number being locally produced steel netpen systems. Homemade wooden systems comprised a significant portion of the total at 11%. Imported steel netpen systems from overseas constituted 10% of the total and eastern Canadian

imports were 6%.

All salmon farming companies indicated that they planned on utilizing locally manufactured netpen systems in all their future purchases. High quality second-hand netpen systems will be preferred by several companies.

The next two years will see a requirement for steel netpen cages in the order of 175 units from the 14 companies surveyed in detail.

All of the barges currently used in the industry are locally manufactured, with 74% purchased from local companies and 26% homemade.

Salmon feed represents one of the largest areas of the supply and service sector to the industry. Although there are three local manufacturers of salmon feed in B.C., there were a number of companies which were importing quantities of salmon feed from the United

States during 1989. This study showed that 50% of the production companies included in this survey had imported out-of-province feed in the past. However, only 14% indicated that they were currently importing out-of-province feed.

Follow-up discussions with several companies indicated some most were not satisfied with the quality of the U.S. feed they received, particularly with poor quality control and lower palatability with the fish.

However, four companies in the industry currently utilize exclusively U.S. feed. Discussions with them indicated that they were quite satisfied with the product and the growth performance of their fish.

A lower price in 1989 of U.S. feed was the primary reason given for using it initially. Several other companies were using it last year, but they have subsequently been placed into receivership.

The hatchery sector currently utilizes U.S. moist feed exclusively for their smolt production facilities. All indicated that higher quality product was their primary reason for importing it. This is clearly an area in which local feed producers should be able to exploit.

Automatic feeders are also currently imported extensively from Europe and the U.S. The reason for this is a lack of a suitable product available locally. Feeding systems are becoming more technologically advanced, with boom, blower and hydraulic pipe systems all now being utilized. There is a strong movement in the industry towards more cost-efficient production. Clearly, more efficient feeders and feed handling will be part of the solution. Demand feeders may be the next generation of feeding systems for salmon farms. Opportunities will therefore exist for local manufacturers to diversify into this highly specialized sector.

In the area of general supplies and services to the salmon farming industry, the vast majority of the salmon farming companies indicated that they anticipated relying on locally available supplies and services to meet their 1990 needs. Exceptions to this were feeders and feeding systems. Several companies indicated they would be relying on imports for their antibiotics, predator control devices and vaccines. In the service sector, 28% of the companies in this survey indicated they would be relying on an import service for their insurance requirements. Computer, legal, and fish diagnostic services would be minor services with minor import components.

Opportunities for the supply and service sector to expand and improve their product line to the salmon farming industry include:

- More effective pharmaceuticals, vaccines and treatments (i.e. for BKD).
- More accurate inventory control systems.
- Low stress graders for smolts and larger fish.
- Automatic fish injection vaccinators.

3.0 IMPACTS FROM THE RESTRUCTURING OF THE B.C. SALMON FARMING INDUSTRY

3.1 Introduction

As previously indicated all of B.C.'s salmon farming companies were left in a financially weak condition with the dramatic price drop in world salmon prices. It forced the receivership or change of ownership of over 20 companies in the industry during 1989. This restructuring also had a negative impact on the supply and service sector. Sales to the industry from a number of companies were reported to be down significantly in 1989 compared to 1988. In addition, there were a number of receiverships in the supply and service sector with companies which were exclusively devoted to the salmon farming industry. On the bright side, several other supply and service sector companies had previously reported that their sales had in fact increased over 1989.

3.2 Methodology

A total of 44 companies were surveyed out of a total of over 100 known companies serving the aquaculture industry. The companies surveyed were selected from a buyers guide and our knowledge of supplier involvement in the industry. It was recognized that many companies supply the industry with specialized goods and services whose aquaculture sales comprise only a small part of their total sales, while other companies are more dependent on the industry.

Additional information was obtained on government programs which have been used to assist with the aquaculture related business of the supply and service sector companies.

Information on aquaculture supply and service sector companies that are currently exporting their products or planning on doing so in the future was also gathered.

3.3 Classification of Aquaculture Supplies Surveyed

Exhibit 3.1 displays the aquaculture supply and service sector companies surveyed by their respective classification. The exhibit shows that every major area of the aquaculture supply and service sector was included in the survey in order to get as broad an overview as possible. A total of 26 supply companies and 18 services companies were included in the sample.

Exhibit 3.2 presents the percentage breakdown of the various sectors of the aquaculture industry served by the supply and service sector. The salmon farming industry is the dominant industry with 66% of the companies serving this sector exclusively. There were 38% of the companies surveyed that serve all sectors of the aquaculture industry. Only 4% indicated that they serve salmon as well as trout and 2% indicated they served primarily the shellfish sector.

3.4 1989 Sales To The Aquaculture Industry

Exhibit 3.3 presents the level of involvement of the supply and service companies in the aquaculture industry as a percentage of their sales to the aquaculture companies compared to their total 1989 sales. It indicates that 45% of the companies surveyed had sales of less than 10% to the aquaculture industry and were not heavily dependent on the industry for the majority of their sales. Another 21% had sales to the industry in the range of 10% to 50%. There were 32% that indicated that they had over 90% of their 1989 sales to the aquaculture industry. These companies were extremely vulnerable to the downturn in the industry which occurred during 1989.

EXHIBIT 3.1 SUPPLY AND SERVICE COMPANIES SURVEYED

A. SUPPLY COMPANIES	NUMBER
Cage Manufacture	2
Feed	2
Pharmaceuticals	2
Nets, Ropes and Twines	3
Plastics	2
Machinery and Equipment	5
Diversified Aquaculture	3
Other	7
Subtotal	**26**
B. SERVICE COMPANIES	
Accounting	1
Environmental	3
Engineering	1
Fish Diagnostic/Veterinarian	2
Insurance	2
Management/Financial/Banks	4
Transportation	5
Subtotal	**18**
Total	**44**

EXHIBIT 3.2: SECTOR OF AQUACULTURE INDUSTRY SERVED

	%
Salmon Trout	66%
Trout Only	-
Shellfish Only	2
Salmon/Trout	4
All Sectors	38
Total	**100%**

EXHIBIT 3.3: PERCENTAGE OF 1989 SALES TO THE AQUACULTURE INDUSTRY

Percentage of 1989 Sales to the Aquaculture Industry	% of Companies
1 - 5	8
6 - 10	13
1 - 20	8
21 - 30	2
31 - 40	3
41 - 50	[illegible]
51 - 60	--
61 - 70	2
71 - 80	--
81 - 90	--
91 - 100	32
Total	**100%**

3.5 History In The Aquaculture Industry

The percentage breakdown of the number of years the companies surveyed were involved in the supply and service of the aquaculture is shown in Exhibit 3.4. There were just over 30% of the companies surveyed that became involved in the supply and service sector of the aquaculture industry five years ago or more. The majority of the companies surveyed (61%) became involved in the industry three to four years ago when the expansion began. Less than 10% became involved two years ago or less.

EXHIBIT 3.4:NUMBER OF YEARS INVOLVED IN THE AQUACULTURE INDUSTRY

Years	Percent of Companies
< 1	-
1	3
2	5
3	22
4	39
5	13
6 - 10	10
10+	8
Total	**100%**

3.6 Change In Sales Status From 1988 to 1989

The supply and service sector companies were asked how their 1989 sales compared to their 1988 sales to the aquaculture industry. The results are shown in Exhibit 3.5. The Exhibit shows that 52% of the supply and service sector companies indicated that their sales were up in 1989 compared to 1988, compared to 30% which indicated that their sales were down. Another 18% said that their sales were the same in both years.

EXHIBIT 3.5: CHANGE IN SALES STATUS FROM 1988 TO 1989

		Percent of Companies
SALES	UP	52%
SALES	DOWN	30
SALES	SAME	18
		100%

Although sales were up for many companies during 1989, a number of the companies indicated that they experienced considerable difficulty with collection of accounts from several salmon farming companies. The companies who indicated that their sales were down had dealt extensively with salmon farming companies that went into receivership during 1989 and had not received payment.

Of the companies that indicated their sales were up in 1989, 60% had their sales increase between 5% to 20% over 1988. A significant 12% reported record sales in 1989.

Of the 30% of the companies that indicated that their sales declined in 1989 compared to 1988, 20% indicated that their sales declined between 5% to 10% while 30% indicated that their sales declined between 11% to 20%. There were 50% of the companies in this category that reported reduced sales in 1989 of between 20% to 50% with a final 10% indicating a drop of between 70% to 80%.

Those companies which saw their sales decline dramatically were companies which had a substantial proportion of their sales (i.e. >50%) to the aquaculture industry. These companies included netting companies and specialized aquaculture supply and service

sector companies.

3.7 Expected 1990 Sales Status Compared To 1989

Exhibit 3.7 displays the expected 1990 sales status compared to 1989 of the companies included in the survey. There were 28% of the companies which anticipated their sales increasing over 1989's sales volume to the aquaculture industry. This is a significant reduction from the 52% which experienced increased sales in 1989.

A larger percentage (31%) indicated that they expected their sales to decline during 1990 compared to 1989. These companies foresee the industry's difficulties to continue and adversely impact their sales by reduced capital purchases and expansions.

The largest percentage of companies (41%) were hoping that their sales during 1990 would be the same as 1989 and would not be significantly reduced.

EXHIBIT 3.6: EXPECTED 1990 SALES STATUS COMPARED TO 1989

		Percent of Companies
Sales	Up	28
Sales	Down	31
Sales	Same	41
		100%

Of the 28% of companies which reported expected increased sales in 1990, 78% of these expected increases in the range of 1% to 10% while the remaining 22% expected increases in the range of 11% to 20%.

Those companies reporting expected 1990 sales declines were again dominated by companies which had an excess of 90% of their sales devoted to the aquaculture industry.

3.8 Changes In Business Practices

The aquaculture supply and service sector companies were asked if they were forced to change their business practices as a result of the financial downturn in the salmon farming industry. Exhibit 3.9 shows the various options provided in the questionnaire and a percentage breakdown of how the companies responded to each option.

A total of 40% of the companies responded it was either very important or essential they sell only to preferred customers as a consequence of the financial downturn. Another 21% reported that it was somewhat important to do this.

With respect to tightening all credit terms to salmon farming companies, 54% of the supply and service sector companies indicated that it was very important or essential to do this in light of the financial downturn.

There were 15% of the companies which reported that it was very important and essential that they have to reduce staff because of their reduced sales level to the salmon farming industry. Another 18% reported that it was important for them to lower operating and overhead costs as well.

EXHIBIT 3.9: RELATIVE IMPORTANCE OF CHANGE IN BUSINESS PRACTICES AS A RESULT OF THE FINANCIAL DOWNTURN

	NOT IMPT. %	SOMEWHAT IMPT. %	VERY IMPT. %	ESSENTIAL %	TOTAL %
Only selling To Preferred Customers	39	21	27	13	100
Tightening all Credit Terms	33	13	36	18	100
Reducing Staff	76	9	6	9	100
Lowering Operating and Costs	75	7	9	9	100

3.9 Employment And Staffing Changes

Exhibit 3.10 displays the current employment generated by the aquaculture industry in the 44 supply and service sector companies included in this survey. The number of employees in a company and the percentage sales to the aquaculture industry were assumed to be direct functions of each other. Employment generated by aquaculture was therefore obtained by multiplying the percentage of business done to the aquaculture industry by the company employment. Exhibit 3.10 shows that there were 155 full-time person years of employment generated by the aquaculture industry and 15 person-years of part-time employment in the survey sample.

EXHIBIT 3.10: PERSON-YEARS OF EMPLOYMENT GENERATED BY AQUACULTURE IN THE SUPPLY SECTOR OF COMPANIES SURVEYED

FULL TIME	155
PART TIME	15

Exhibit 3.11 shows staffing changes made by the companies in the last two years. It shows that total staffing of the 44 companies was reduced by 50 positions over the last two years with other companies increasing their staff by 23 positions.

Companies which have been hardest hit with staffing decreases were again those which have most of their sales in the aquaculture industry. Particularly hardest hit were several equipment suppliers as well as net companies.

EXHIBIT 3.11: STAFFING CHANGES MADE BY AQUACULTURE SUPPLY AND SERVICE SECTOR COMPANIES IN THE LAST TWO YEARS

STAFFING DECREASES	50 POSITIONS
STAFFING INCREASES	23 POSITIONS

3.10 Receiverships in 1988/89

There were several notable aquaculture supply and service sector companies that were placed into receivership during 1988 and 1989. These companies included:

Scantech Resources Ltd.

This company was formed in late 1985 and was the largest supply and service sector company devoted exclusively to the aquaculture industry. They supplied a wide range of products including netpen systems, nets, feed, and consulting services. Their peak employment level was approximately 50 employees. They were placed into receivership in late 1989.

Powell River Net Loft Ltd.

This company was involved in supplying the salmon farming industries with nets. It was formed in late 1986 and employed approximately 25 people at its peak. Its dependence on the salmon farming industry and inability to diversify resulted in it going into receivership in early 1989.

Aquasteel Ltd.

This was the largest local netpen manufacturer and was formed in early 1986. They supplied a number of companies with their product. The fall off in purchases of netpen systems in late 1988 caused their ultimate receivership.

Sea Farm Trading Inc.

This company was part of Sea Farm Trading Inc. of Norway and supplied a wide range of supplies to the industry. The parent company decided to close down its Canadian

operation in late 1989.

3.11 Government Funding Programs Utilized

The vast majority of the aquaculture supply and service companies have not utilized any potential government funding programs which are currently available. There were over 20% of the companies surveyed which had attempted to source government funding programs to either make capital purchases to expand their business or for export development. Most of these companies complained of the amount of paperwork, length of time for obtaining funding and very narrow scope of the funding program. These companies subsequently did not actively pursue the funding programs through until completion or were rejected outright. Only three companies indicated that they had been able to access any of these funds which are currently available.

Only one company made use of the Small Business Incentive Program (SBP). This was used to expand the company's plant and to increase their production output.

3.12 Government Assistance To The Aquaculture Supply And Service Sector

Three areas were identified in which the government can more effectively assist the aquaculture supply and service sector:

1) Easier access to funding programs;
2) Export development programs;
3) Expanded Social Service Tax exemptions.

The survey findings also suggest the sales tax exemptions for the aquaculture sector as they presently stand are inequitable compared to other salmon farming regions in Canada, and to commercial fishermen and agricultural farmers in B.C. The following table highlights this.

PROVINCE	SECTOR	NO. OF TAX EXEMPT ITEMS
British Columbia	Salmon Farming	24
New Brunswick	Salmon Farming	80+
British Columbia	Commercial Fishermen	110+
British Columbia	Agricultural	300+

3.13: Export Development Potential

Nearly 40% of the companies surveyed indicated that they were already exporting aquaculture supplies and services to the United States and abroad. Many B.C. companies have developed innovative aquaculture products such as micropore diffusers and live-fish conveying equipment. The financial downturn of the industry in 1989 forced many companies to look abroad for sales in light of reduced markets here in British Columbia.

Exhibit 3.12 displays the aquaculture supplies and services that this study identified as being currently exported and the export markets penetrated. This list highlights the specialized nature of the products and services offered by B.C. aquaculture supply and services companies. It also highlights the diversity of the export market that has already been penetrated export markets include the United States, Chile, Scotland, Iceland and Norway as well as the East Coast of Canada. This is indicative of the expansion of the aquaculture industry worldwide and the increasing demand for related supply and services.

The Pacific Rim, the largest aquaculture producing area in the world is presently a virtually untapped market by B.C. aquaculture supply and service companies. Several companies surveyed indicated their strong desire to investigate export possibilities in this region.

The few B.C. aquaculture supply and service companies that have been able to source government export development funding have shown that they have successfully expanded their sales through these initiatives. These companies therefore encourage that further effort by governments be put into expanding their programs to include other aquaculture supply and service companies.

EXHIBIT 3.10: CURRENT EXPORTS OF THE B.C. AQUACULTURE SUPPLY AND SERVICE SECTOR

Supply and Service	Export Markets Penetrated
Accounting/Management Services	U.S., Scotland, Spain
Air Cargo	North America, Japan
Aquaculture Consulting Services	U.S., Chile
Engineering Services	U.S.
Fish Boxes	U.S.
Gas Diffusers and Systems	Iceland, Norway, Scotland, U.S.
Grading/Harvesting Equipment	New Brunswick, U.S.
Hatchery Equipment (pumps, pipes, tank)	U.S.
Insulated Fish Totes	U.S.
Mussel/Oyster Floats	U.S.
Predator Control Devices	U.S. and Chile
Smolt Transport Tanks (Air)	U.S. and Norway

REFERENCES

1. Association of Professional Engineers of B.C., The Engineers Act, 1979.

2. B.C. Salmon Farmers Association, Salmon Farming: A Growth Industry-Economic Impacts in British Columbia, 1988.

3. B.C. Salmon Farmers Association, Current Developments in World Salmon Markets: Implications For The Canadian Salmon Farming Industry, Department of Fisheries and Oceans, Economics and Commercial Analysis Report No. 46, 1990.

4. Canadian Aquaculture Supplier's Association, Aquaculture Suppliers of British Columbia Industry Strategy., B.C. Ministry of Agriculture and Fisheries, 1988.

5. Canadian Aquaculture Suppliers Association, "Preliminary Recommendations From June 9, 1989 Meeting," unpublished summary of the results of a meeting requested by the Minister of Agriculture and Fisheries of cage suppliers, financial institutions and insurance companies.